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Prevalence and Prevention Strategies for Iron Deficiency Anemia in Pregnancy: A Systematic Review of Data from Developing Countries

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ABSTRACT

Background: Anemia related to pregnancy is a widespread issue impacting both industrialized and developing countries. This condition is linked to increased rates of morbidity and mortality, adverse birth outcomes, and impaired infant development, carrying significant health implications. **Methods:** Adhering to the PRISMA 2020 guidelines, this review ensured methodological rigor and timeliness. **Result:** The study conducted a comprehensive review of over 3,000 publications sourced from reputable databases, including ScienceDirect, SagePub, and PubMed. Following an initial screening, seven publications were identified as warranting more in-depth analysis. Consequently, a thorough review of these selected studies was performed to ensure a detailed and rigorous evaluation. **Conclusion:** To mitigate iron deficiency anemia in pregnant women, it is essential to promote awareness of proper nutritional intake, particularly regarding iron and folic acid supplements. Additionally, providing counseling on pregnancy preparedness for both brides and grooms is crucial for effective prevention.

Keyword: anemia, pregnancy, developing countries

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INTRODUCTION

Pregnancy-related anemia is a significant global health issue, impacting both industrialized and developing nations. This condition is associated with increased morbidity and mortality, adverse birth outcomes, and delayed infant development, reflecting its serious health implications. Among the detrimental effects of anemia during pregnancy are preterm delivery, low birth weight, early rupture of membranes, preeclampsia, and elevated risks of maternal and fetal death.[1,2] Addressing these consequences is crucial for improving maternal and neonatal health outcomes.

Anemia in pregnancy is defined by a hemoglobin (Hb) level falling below 11.0 grams per deciliter (g/dL), with thresholds adjusted for different trimesters: less than 11.0 g/dL in the first trimester and less than 10.5 g/dL in the second and third trimesters.[3] This condition arises when red blood cell production fails to maintain adequate hemoglobin levels, leading to a spectrum of potential health complications. Accurate diagnosis and management of anemia are essential to mitigate its impact on both mother and child.[4]

Efforts to reduce anemia rates in developing countries, such as Indonesia, remain a critical concern. The World Health Organization (WHO) aims to cut the prevalence of anemia among women of reproductive age by 50% by 2025. The Indonesian government has initiated programs, including the distribution of iron supplements, to combat anemia. However, the COVID-19 pandemic has exacerbated health challenges and disrupted the implementation of these programs, affecting overall health and anemia management [5,6].[5,6] Effective iron supplementation, adherence to treatment, and addressing additional factors such as endemic diseases and genetic influences are vital for improving anemia outcomes in pregnant women.[7-10]

METHODS

Protocol

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The investigation adhered rigorously to the Preferred Reporting Items for Systematic Review and Meta-Analysis (PRISMA) 2020 guidelines, ensuring meticulous compliance with established methodological standards. By strictly following PRISMA 2020 criteria, the study aimed to enhance clarity, replicability, and systematic rigor throughout the review process. Comprehensive methodologies were employed for literature searching, data extraction, and synthesis of findings, meticulously applied to reduce biases and reinforce the validity and reliability of the conclusions drawn.

Criteria for Eligibility

This study provides an in-depth review of research conducted over the past decade on the impact of iron deficiency anemia during pregnancy. By systematically analyzing and synthesizing data from a range of studies, the research aims to identify patterns and inform the enhancement of patient care strategies for individuals affected by this condition.

The primary objective of this study is to highlight critical insights drawn from a broad spectrum of scholarly literature, thereby improving our understanding of the complexities surrounding iron deficiency anemia in pregnancy. To ensure the accuracy and comprehensiveness of the review, stringent inclusion and exclusion criteria were applied. Only peer-reviewed articles published in English between 2014 and 2024 with a valid DOI were considered, thereby validating their authenticity. Non-research materials such as reviews, editorials, and duplicate publications were excluded to maintain the focus and integrity of the dataset.

The rigorous systematic approach utilized in this study ensures that the data included is both relevant and reliable. This methodology provides a robust foundation for generating meaningful insights and advancing clinical practices related to the management of iron deficiency anemia in pregnant patients.

Search Strategy

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We used "anemia OR iron deficiency OR pregnancy" as keywords. The search for studies to be included in the systematic review was carried out using the PubMed, SagePub, and Sciencedirect databases.

Data retrieval

The authors began by conducting a meticulous preliminary review of each article, assessing its abstract and title to determine its relevance before moving on to a more in-depth analysis. Only those studies that were aligned with the study's objectives and met the specified inclusion criteria were selected for further examination. This approach facilitated the identification of consistent patterns across the research.

To ensure uniformity, the review was restricted to full-text articles published in English. A rigorous screening process was employed to ensure that only content directly relevant to the study's focus and adhering to the inclusion criteria was considered. Articles that did not meet these criteria were systematically excluded from the final evaluation.

The evaluation involved a thorough review of various factors, including study design, titles, authors, publication dates, research locations, and methodologies. This comprehensive approach guaranteed that the analyzed content was of the highest relevance and quality, thereby reinforcing the robustness and validity of the study's findings.

Quality Assessment and Data Synthesis

The authors conducted a detailed review of each article's abstract and title to determine its relevance for further investigation. Following this preliminary screening, the selected documents underwent an extensive evaluation. This rigorous process ensured that only the most pertinent studies were chosen for in-depth analysis. By streamlining the selection process in this way, the authors were able to perform a thorough and nuanced assessment of the research, enhancing the overall clarity and depth of the review.

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Table 1. Search Strategy

Database	Search Strategy	*Hits*
Pubmed	*("anemia" AND "iron deficiency" AND "pregnancy" AND "developing countries")*	229
Science Direct	*("anemia" AND "iron deficiency" AND "pregnancy" AND "developing countries")*	2577
Sagepub	*("anemia" AND "iron deficiency" AND "pregnancy" AND "developing countries")*	511

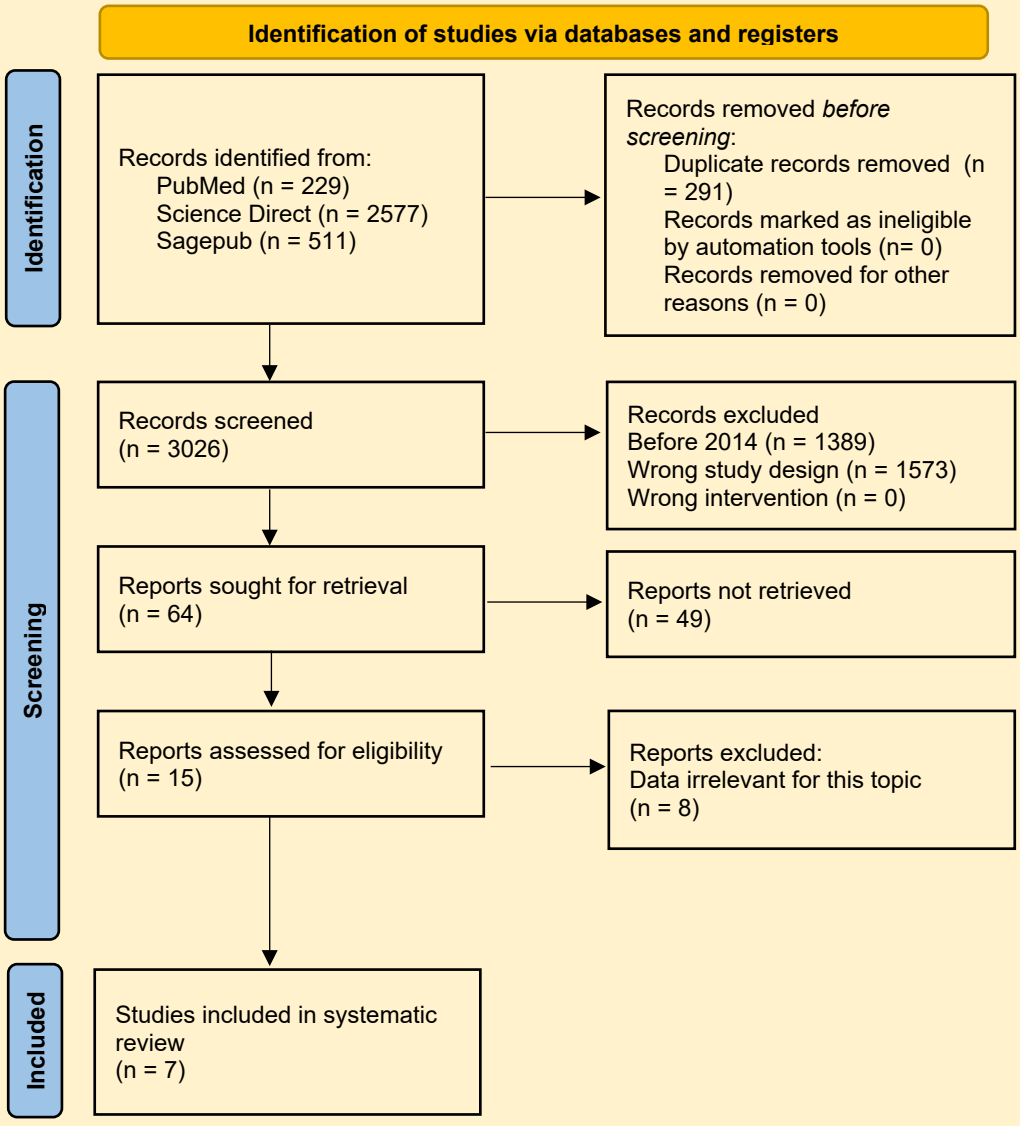


Figure 1. Article search flow chart

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Table 2. Critical appraisal of Study

Parameters	(Widyawati et al., 2015)	(Mansyur et al., 2019)	(Darmawati et al., 2020)	(Judistiani et al., 2020)	(Wirawan et al., 2022)	(Sigit et al., 2024)	(Syarif et al., 2024)
1. Bias related to temporal precedence							
Is it clear in the study what is the "cause" and what is the "effect" (ie, there is no confusion about which variable comes first)?	Yes	Yes	Yes	Yes	Yes	Yes	Yes
2. Bias related to selection and allocation							
Was there a control group?	No	No	No	No	No	No	No
3. Bias related to confounding factors							
Were participants included in any comparisons similar?	No	No	No	No	No	No	No
4. Bias related to administration of intervention/exposure							
Were the participants included in any comparisons receiving similar treatment/care, other than the exposure or intervention of interest?	Yes.	No.	No.	Yes.	Yes.	No.	No.
5. Bias related to assessment, detection, and measurement of the outcome							
Were there multiple measurements of the outcome, both pre and post the intervention/exposure?	No	No	No	No	No	No	No
Were the outcomes of participants included in any comparisons measured in the same way?	Yes	No	No	Yes	Yes	No	No
Were outcomes measured in a reliable way?	Yes	No	No	Yes	Yes	No	No
6. Bias related to participant retention							
Was follow-up complete and, if not, were differences between groups in terms of their follow-up adequately described and analyzed?	No	No	No	Yes	No	No	No
7. Statistical conclusion validity							
Was appropriate statistical analysis used?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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RESULT

Our investigation began with a comprehensive collection of research articles from well-regarded databases, including Science Direct, PubMed, and SagePub. Through a detailed, multi-step screening process, we identified seven key papers highly relevant to our systematic review. Each selected paper was then rigorously analyzed, and specific topics within the reports were chosen for further in-depth review. To facilitate a clearer understanding of our findings, we have summarized the key information in Table 3.

Table 3. The literature included in this study

Author	Origin	Method	Sample	Result
Widyawati et al,[11] (2015)	Indonesia	Cohort study	354 participants	The research involved 354 participants and found that an intervention group had a higher adjusted odds ratio for increased hemoglobin at 35-37 weeks of gestation compared to a control group. Both groups received five or more prenatal care visits, with professional birth attendants attending every birth in both groups.
Mansyur et al.,[12] (2019)	Indonesia	Qualitative study	105 participants	The study involved 105 female employees who participated in 14 focus groups (FGDs). The majority understood anemia symptoms and indicators. They hoped the company would improve factory health services by reducing costs, increasing food accessibility, and limiting dangerous materials that are risk factors for anemia at work.
Darmawati et al,[13] (2020)	Indonesia	Qualitative study	18 participants	The study identified three main themes: inadequate health practitioner competency, sociocultural issues, and inadequate

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				facilities, infrastructures, and supplement support.
Judistiani et al,[14] (2020)	Indonesia	Cohort study	345 participants	The study found that serum ferritin level in the first trimester is the most significant indicator of anemia in the third trimester of pregnancy. Hepcidin and sTfR showed subpar results. The revised ferritin level cutoff point of ≤27.23 ng/ml produced the best ROC, with the prior cutoff criterion below 30 ng/ml. These recent values were superior.
Wirawan et al,[15] (2022)	Indonesia	Cohort study	637 participants	Maternal pre-pregnancy anemia remains an independent risk factor for anemia after risk stratification based on potential confounding variables. This includes children who were still breastfed, received water before six months, had normal or underweight pre-pregnancy body mass index, and those without anemia in their mothers.
Sigit et al,[16] (2024)	Indonesia	Cross sectional study	1995 participants	Anemia affects 49% of teenage girls in Karanganyar, with inverse relationships with BMI and Mid-Upper-Arm Circumference. Consumption of fruits and vegetables is negatively correlated with anemia, while no correlation was found between anemia and menstrual state.

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Syarif et al, 2024[13]	Indonesia	Cross sectional study	112 participants	A study found that 78% of pregnant women were iron deficient, with practices related to using iron enhancers and low knowledge being the main variables linked to iron insufficiency. The results suggest that iron supplementation may be a potential solution.

DISCUSSION

Anemia during pregnancy is a prevalent issue in low- and middle-income countries, characterized by a decrease in hemoglobin levels despite an increase in red blood cell mass. This condition can result in poor fetal growth and significant maternal complications, including bleeding during pregnancy, delivery, and postpartum. According to the World Health Organization (WHO) data from 2016, approximately 40% of pregnant women worldwide are affected by anemia. In Indonesia, the situation is even more severe, with RISKESDAS 2018 reporting an anemia prevalence of 48.9% among pregnant women, up from 37.1% in 2013. Notably, the highest prevalence of anemia is observed in women aged 15–24 years (84.6%), followed by those aged 25–34 years (33.7%), 35–44 years (33.6%), and 45–54 years (24%).[6,18,19]

Anemia in pregnancy is defined by the WHO as having a hemoglobin concentration below 11 g/dL. Both biological and non-biological factors contribute to this condition. Biological factors include infections, chronic illnesses, and micronutrient deficiencies, while non-biological factors encompass sociodemographic characteristics, dietary habits, adherence to iron supplementation, and body mass index (BMI).[20,21] The treatment approach for anemia largely depends on its underlying cause, with iron deficiency being the most common. For managing iron deficiency anemia, intravenous iron therapy is often preferred over oral iron due to its superior efficacy in increasing hemoglobin levels

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and its lower incidence of gastrointestinal side effects.[22] Oral iron therapy, while effective for mild cases, can lead to significant side effects such as gastric intolerance and constipation in about 20% of patients, which intravenous options can mitigate.[22]

In cases of moderate iron deficiency anemia and iron deficiency without anemia, the standard treatment involves oral iron supplementation of 160–200 mg/day, preferably on an empty stomach to enhance absorption. This approach is also recommended for those with low iron stores (ferritin < 30 µg/L) at the start of pregnancy. Iron supplementation of less than 100 mg per day, such as the 80 mg in some multivitamins, is generally insufficient. The effectiveness of the treatment should be evaluated after 2-4 weeks to ensure adequate response.[22]

Antenatal care (ANC) plays a crucial role in managing anemia and other pregnancy-related issues. ANC includes routine examinations performed by healthcare professionals, typically occurring at least four times during pregnancy. These visits involve a comprehensive assessment, including history taking, physical and obstetric examinations, laboratory tests, and specific health checks. Early identification of anemia and other health issues through ANC allows for timely intervention and treatment, potentially reducing anemia-related complications and improving outcomes for both the mother and fetus.[23]

Adherence to ANC service standards is vital for effective pregnancy management. According to these standards, ANC should be administered at least four times during pregnancy—once in each trimester. Essential examinations during these visits include weight assessment, blood pressure monitoring, fundal height measurement, tetanus vaccination, iron supplementation, and screening for sexually transmitted infections. Regular ANC visits help in the early detection of anemia and prompt administration of iron supplements, thereby lowering the risk of anemia-related complications.[23]

CONCLUSION

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Anemia during pregnancy is a common issue in low- and middle-income countries, affecting approximately 40% of pregnant women worldwide. Iron deficiency is the most common cause, with intravenous iron therapy being preferred due to its efficacy and lower gastrointestinal side effects. Antenatal care (ANC) plays a crucial role in managing anemia and other pregnancy-related issues, allowing for timely intervention and treatment, potentially reducing anemia-related complications and improving outcomes for both the mother and fetus.

DISCLOSURE STATEMENT

Disclosure Statement: The authors have no conflicts of Interest to declare.

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